

Anthrax.

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Anthrax (from the Greek - coal, carbon) - a sharp infectious disease encountered (usually sporadically) more often in the state of the cutaneous form, less often in the state of the pulmonary, intestinal, or septic form. Anthrax is known from ancient times under the name of "Holy Fire"; later under the name of "Persian Fire" (Ignis Persicus). In the works of Hippocrates, Homer, Galen Celsius and others are found many references to this disease. Morond (1766) gave the first authentic description of human anthrax. In the 19th century it was experimentally proved that anthrax in humans and animals is one and the same disease. In 1849 Pollender and later Davaine discovered the causative agent of anthrax (*Bac anthracis*). In 1876 Koch produced a pure culture of anthrax and established the capability of the anthrax bacilli to produce spores. Pasteur prepared an anthrax vaccine which upon being applied to animals, sharply confined the spread of the anthrax epizootics. The disease evidently received its name (Sibirskaya Yazva-Siberian Ulcer - Tr note) after a large epidemic in Siberia in 1864-1866. Anthrax is found in all parts of the world in all countries. Prior to World War I in Germany a yearly average of up to 7000 head of cattle and other domestic animals died from this disease, with the morbidity among humans equalling 0.02 per 10, 000 population. Approximately similar population morbidity figures were registered at that time in Austria and Poland; in the USA - 50 % less. In pre-revolutionary Russia anthrax was observed quite frequently; that is explained by the agricultural economy of small holdings and the inadequacy of the veterinary service. Thus, by the far from complete official data (Stefanskii), from 1904 through 1908, 218,956 animals and 80,498 humans contracted anthrax.

In the USSR the morbidity of anthrax sharply dropped in conjunction, mainly, with the collectivization of agriculture, the improvement of the sanitary-hygienic conditions of the industries processing the animal products, and the strengthening of the veterinary organizations.

*Bac. anthracis*, non-motile, aerobe, grows rather quickly on common nutritious mediums. Capable of spore formation. The spores insure a continuance of the presence of the infection; they are exceptionally durable and retain their viability for years and even decades (for instance, in water-approximately 10 years; in dry garden earth - up to 15 years). The spores are also resistant to the action of physical and chemical factors. Thus, a dry heat at 120° kills them only after 2 hours, but at 170°- in 10 minutes. Boiling kills the spores in 10 minutes; fresh calcium hypochlorite, a 2% solution of formaldehyde and a 1 % solution of mercuric chloride- after 1-2 hours. The spores die after 4 hours exposure to the action of direct sunlight. The salting, drying and tanning of the skins and also the pickling of the meat (corned beef, ham) do not kill the spores in them.

Under natural conditions the spores have a basic importance in the infecting of animals. Usually, having entered with the food into the organism of an animal, the spores produce a vegetative form in it which leads to the development of the disease. The vegetative forms of the anthrax pathogen are less resistant. They die, for instance, after an hours exposure to a heat of 56-58°, but at 80°- during the first few minutes. At a temperature below 14° they lose their propagation capability. They quickly die under the action of the following dissolutions: mercuric chloride 1:1,000, 5 % lysol, a 5 % carbolic acid solution, 0.2 % chlorine water and others. They also quickly die under the influence of sunlight.

The anthrax rod must be distinguished from the pseudoanthrax or the so-called anthracoidal bacilli which are distinguished from the true anthrax pathogen by their mobility, a strong hemolytic capability and the absence of capsules.

Epidemiology- The basic sources of infection are sick animals. Those most frequently affected are: the large horned animals; sheep; horses. Those less frequently infected are: deer; goats; camels and swine. There are also other animals (cats, hares and rats) susceptible to the disease. Besides the sick animals, soil infected by the spores is another reservoir of anthrax infection. In several regions the infection is extremely long lasting ("Cursed Fields"; marshlands and inundated lands). Water may be infected by spores in the discharge water from tanneries and wool-washing works or by the excreta from sick animals, etc. During the summer months the blood sucking insects have a slight importance in the spreading of anthrax, particularly the horsefly (Tabanus) and the stable fly (Stomoxys calcitrans) which are mechanical carriers of the infection from sick animals or their carcasses to the healthy animals and at times even to humans. Man is slightly susceptible to anthrax, more than 90 % of the illnesses are related to an infection of a professional character (herdsmen, agricultural workers, veterinarians, slaughter house workers, harness makers, curriers, furriers, wool carders, fullers, brush-makers, rag sorters; in the army- soldiers of cavalry units, personnel of the slaughter houses and the by-products industry, etc). Produce from animal material (fur coats, fur caps, fur gloves, etc) inoculated with the anthrax infection and being included in the army equipment can be a source of infection. It is known, for example, that during the Russo-Japanese war of 1904-1905 in several military units of the Russian army, which had received new clothing (fur caps, fur coats), 976 cases of the cutaneous form of anthrax developed, with the localization of the primary changes in 76.5 % on the occiput, the cheek, the skin of the forehead, etc. These diseases ceased as soon as the infected clothing was removed. An epidemiological danger in relation to anthrax infection may be found in the cattle graves where the carcasses of the dead animals have been interred without the proper precautions and that may be uncovered during the earth work for the construction of military objects. Finally, transportation (especially railroad cars) that has been dirtied by sick animals can serve as a cause of infection to humans and animals. Group outbreaks are recorded from the processing and consumption of meat from sick animals. Cases are known where people were infected from shaving brushes. It is very seldom that a per-

son is infected from another human or that an animal is infected from a human. In Agriculture, the maximum sicknesses among humans occur during the summer months. A person that has recovered from anthrax receives an immunity that is rather firm but not absolute. According to Kolobkovaya's material from the Botkin hospital (Moscow) the distribution of anthrax patients by epidemic groups for 15 years is as follows: professional-industrial - 60.8 %, professional-agricultural - 18.6%, incidental occurrence - 15.1 %, and unestablished - 5.5 %.

Clinical- The anthrax pathogen can penetrate the human organism by various routes: through the skin coverings, the mucous membranes of the respiratory tracts, and the intestinal tract. The infection's entrance points affect the clinical process of anthrax in man. The cutaneous, pulmonary, intestinal and septic forms differ. Pathogenically, these forms are divided into the primary and the secondary. The incubation period lasts from 1 to 7 sutki (24 hour periods-Tr note), usually it equals 2-3 days. In the cutaneous form, the following successively changing stages of metamorphosis are observed at the lesion: a papule, a vesicle, a pustule, and an ulcer. At the infection's entrance points at first appears a reddish blotch which very quickly changes into a reddish purple or a copperish red papule slightly raised above the level of the skin; a slight burning and itching is felt at the lesion. After a few hours the papule becomes a vesicle (2-3 mm in diameter) with a serous and later a dark sanguinolent content (pustula maligna). The pustule bursts or more often the patients themselves break it by scratching. A scab forms in its place, quickly grows larger and darkens, small secondary pustules form around the scab and proceed through the same stages of metamorphosis that lead to the merging of the newly developed scabs into a single great blackish-brown scab. The scab lies hard set as though it were a strongly baked or burnt crust, often slightly concave and tuberos. The infiltrate beneath the scab has the look of a reddish purple bank raising above the level of the healthy skin. The joining of the massive and sometimes broad edemas is typical, especially on the areas with a loose subcutaneous cellular tissue such as, in particular, on the face. With a percussion in the area of the edema, a gel-like quivering often appears (Stefanskii symptom). When the ulcers are localized on the labial mucosa, there are noticed particularly large edemas which can spread to the upper respiratory tracts and lead to asphyxia. The large edemas at times lead to local necroses. In several cases very large edemas are the primary manifestation of the anthrax process (without noticeable reactive changes at the point of infection). These cases usually proceed very difficultly and within 2-4 days usually end with death. In the cutaneous form of anthrax, in addition to the local edemas there is a local anesthesia that is extremely important for a differential diagnosis with the cutaneous forms of plague and tularemia with which there is no anesthesia. Further, a joining of the regional lymphadenitises and lymphangitises is observed. Of the general clinical symptoms one should note in the cutaneous forms of anthrax are the discomfort, the tremor and headache. The fever (temperature as high as 38-39° and higher) in favorable cases lasts approximately 5-6 days and its end usually coincides with the improvement of the local process. After that begins the gradual

disappearance of the edemas, lymphadenitis and lymphangitis, also the disengagement of the scab and the complete healing of the ulcer (usually with a scar). In the unfavorable cases, the disease is complicated by metastasises (the secondary intestinal, pulmonary, or septic forms). In such cases there are noticed new increases in temperature with amplitudes, chills, strong headaches, tachycardia, at times a cough with hemoptysis, or an emaciating bloody flux and vomiting of blood. Secondary pustular and other skin rashes (metastasises) are possible. A mass of anthrax bacilli can be detected in the blood by a microscopic study. In a quickly worsening condition of the patients, there is a connected sopor and then a coma, although at times death may come even earlier. Anthrax meningitis (lethal complication) is possible.

In the gastro-intestinal form of anthrax the disease usually begins with sharp cutting pains in the stomach which are sometimes preceded by chills, headache and a definite weakness. The nausea and vomiting are soon mingled with bile and blood and also a bloody flux. With intestinal paresis, a picture of blockage develops that have caused test laparotomies to be made. A sharp intoxication is accompanied by a strong fever (up to 40° temperature) with great amplitudes, tachycardia, a progressive weakness of the heart and near the end edema of the lungs. The disease most frequently lasts 3-4 days and usually ends with death.

A high percentage of lethal results are observed in the primary pulmonary form of anthrax, characterized by a short incubation, pains in the chest, a cough, sharp chills and a strong (septic type) fever. In a few patients a cold and lachrimation are noted. Bronchopneumonia, with an abundance of dry and moist rales and an emission of a foamy liquid bloody sputum in which are found a mass of bacilli, is objectively noticed; hemorrhagic pleurisy often occurs. In the majority of cases, upon evidencing an acutely progressive weakening of the body, the disease usually produces death in 2-3 сутки. The average lethality amounts to 15 %, but in the visceral forms - as high as 98 %.

In the differential-diagnostic relationship, it is important to distinguish anthrax from plague, glanders, tularemia, the common boil and carbuncle, sepsis and meningitis of a different etiology, hemorrhagic gastroenteritis, sometimes ileus, etc. One must remember the local anesthesia in the cutaneous form of anthrax, the edemas, the black scab, etc. One must fully study the data of the epidemiological anamnesis and the laboratory investigations of the corresponding materials (a specimen obtained by puncture of a pustule or ulcer, discharge of a carbuncle, vomited matter, feces, urine or sputum). On an autopsy impressions or slices of tissues (spleen) are taken. The tentative answer is made on the basis of a microscopic bacterial study from the laboratory, but the final answer - only on the basis of cultures and biological tests on the animals. The precipitation reaction by the Ascoli method allows one to detect the presence of the specific antigen even with a negative bacteriological investigation; but, for an intra-vitam diagnosis it does not have an advantage over the culture and biological tests.

The modern treatment of anthrax results in a combination of serotherapy with neosalvarsan (the latter is intravenously injected with a calculation of 0.01 to 1 kg of the patient's weight). The preliminarily heated antianthrax serum is usually subcutaneously injected in a 100 to 200 cm<sup>3</sup> dose for a grown person, and then the injection is repeated within 24-48 hours until a clear clinical crisis has developed. In the cutaneous form of anthrax, salves and bandages are locally applied. Lately there have appeared favorable reports concerning penicillin therapy in the cutaneous form of anthrax. With the internal forms, the prognosis usually remains unfavorable. Anthrax patients are hospitalized in separate rooms. Separating the nursing articles, dishes, gowns is particularly necessary with the internal forms, and it is even better to isolate the personnel. The patient's things are carefully disinfected. In the ward, a liquid disinfection (a washing with mercury bichloride 1:500 + 3 % phenol) is carried out. The patient's dishes are boiled. Sputum and all other excretions are locally disinfected with a 5 % solution of carbolic acid or a fresh 10 % solution of lime chloride; used bandaging material is burned. The personnel work in specific gowns, systematically carrying out a constant disinfection, and with the pulmonary form - wearing eye protectors and gauze face masks. The convalescents are discharged after the disappearance of the clinical symptoms, and in particular, only after the complete closing of the cutaneous defects. In the internal forms of anthrax, a person is discharged after a complete clinical recovery and a twice-repeated negative result of the corresponding bacteriological investigations with a 5 sutki interval. A medical observation, lasting 8 sutki from the cessation of contact, is established for those individuals who have come in contact with sick people or animals; it is expedient to give them the antianthrax serum as a prophylactic measure - up to 50 cm<sup>3</sup> depending on the epidemiological conditions and the degree of contact.

In relation to those who have become ill, the following measures will be carried out: patients suspected of having anthrax will be immediately sent to the isolation ward and evacuated to an infectious disease hospital (an immediate report of the disease will be made); the conveyance of the patients will be carried out with a strict observation of the usual measures to prevent the spreading of an infection.

Prophylactics - Along the veterinarian line, the following will be done: 1) isolation of the plainly sick animals, and also those suspected of having anthrax; 2) burning of the carcasses of animals that have died and objects that are infected (manure, bedding litter and others); 3) disinfection of the places where the sick animals are quartered; 4) purification of watering places; 5) drainage of marshy areas; 6) plowing under the soil. Upon the outbreak of anthrax among animals, a quarantine is established which is lifted only after a half month has passed from the cessation of the disease among the animals, and after the prophylactic vaccination of the cattle. In case it is impossible to burn the carcasses they are buried in remote empty areas (cattle graveyard) which are fenced off. A dry place is selected for this, the hole is dug to a 2 m depth and the carcass is laid on a thick layer of lime chloride (up to a 10 cm thickness) and is covered with a similar layer from above. The body is hauled in an impervious box on the floor of which is also strewn lime. The box is

afterwards disinfected with a 5 % solution of lysol, carbolic acid or a 2 % solution of formalin. The place where the stricken animal was quartered is heavily flooded with disinfecting solutions. Harness, saddles and other leather items are rendered harmless by a 2 % solution of hydrochloric acid with an addition of a 10 % solution of sodium chloride after 9-10 hours. Wool, fur coats, fur caps and similar objects are disinfected in steam-formalin chambers. Fur products for the army are made exclusively from materials which have given a negative Ascoli reaction. For the prevention of a transmittal of the disease to military units, the medical-veterinary measures in regards to the horse complement (especially with replacements) are strictly enforced. A strict sanitary inspection is made of sheepskin-fur articles going into the equipment of the units. Upon an outbreak of anthrax connected with the wearing of fur clothing, besides the measures indicated above, the following is necessary: 1) accurately establish the enterprise and warehouse from which the articles came; 2) having temporarily confiscated the entire lot, subject it to a thorough disinfection in steam-formalin chambers (after that the sleeves and collars are lined with a cotton cloth); 3) the place from where the consignment of clothing came must take prophylactic measures at once; 4) report to the highest medical supervisor.

Meat from animals with anthrax will not be permitted to be used as food under any circumstances. Among the newer biopreparations used for prophylactic vaccination, special attention has been earned by the vaccine "S.T.I." (see Vaccines) which received wide distribution, replacing the earlier preparations.

#### Literature

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